

REVELATIONS IN REGARD TO THE AFRICAN SLAVE-TRADE.

(From the *Weekly Gazette*, November 15.)

ARRIVING at present is of importance which is likely to throw light upon the East African slave-trade and upon the means by which that dreadful traffic is carried on. It is, however, a fact question as to how far it is expedient to publish information on the subject and how far it may be well to keep that information quiet just now and to reserve it for the private use of Sir Bartle Frere. We understand that the Indian and English newspapers are carefully guarded by the censors of the Sultan of Zanzibar, or at least are translated to them when these papers contain anything relating to the Sultan's rule, and it is likely enough that the attention which the East African slave-trade is attracting at present will put the parties who engage in it and those who connive at it upon their guard. That, however, was done effectually when Dr. Livingstone's letters were published, and when, on the top of that, the appointment of Sir Bartle Frere to suppress the slave-trade was publicly announced. We have no doubt that the slave dealers and their agents and the officials (of whatever nationality) who have connived at the slave-trade are, by this time, as much alarmed as much as they guard as they will, and we have no doubt that the subject calls out more information and encourages people to come forward and state what they knew in regard to the matter. In such cases a certain desire to make a clean breast of it often seizes upon men's minds, and it ought to be encouraged to the utmost. It may be remembered that in the case of the *burnt of the ship Aurora* two years ago, the confession of one of the criminals led all the others to give each other in stating the facts of the case, and, indeed, but for their confessions, it is doubtful if any of them could have been convicted. There was a good deal of sense in the advice given by a French murderer just before he was guillotined: *c'est ce que me parait*. But fortunately for society, criminals do not act rationally upon this maxim, and the knowledge that there is a certain to often quite ready to sow the truth, or at least something approaching to it, and especially so far as others are concerned. Therefore, and although there may be some pieces of information in regard to the slave-trade which it is wise to keep quiet at present, we consider that, except when some special cause for reticence exists, it is well to publish any information regarding the slave-trade which comes from any reliable source, and to let those who are engaged in this accursed traffic perceive that more is now known about their doings than they may have conceived possible. In particular, it would be well if the names of slave dealers could be mentioned; for, as we have said, they are probably quite as much on their guard now as they ever be, and, moreover, the mere fact of their having become marked and suspected is likely to bring out evidence against them which would otherwise remain in the background. Dr. Livingstone, "the richest man in Zanzibar," as one of the chiefs of the wretched engaged in secretly carrying on the slave-trade; but we have been informed by Hindoo merchants who are not likely to have any interest in concealing him from justice, that Ludha Damsie is now dead—that about a year ago he passed into that land where even thence cease from troubling, and where so many of his victims have found release from "slavery" said Ludha Damsie, however, may have had partners in those transactions which have caused such widespread misery and destruction, and no one ought to be lost in bringing into the light. Another person against whom positive information has been laid in Bomai is a Persian of the name of Ali Goolah, who has settled in Zanzibar. It is alleged that he has been known to deal in slaves in that city, and is the principal slave agent for the British and the Sultan of Zanzibar. It is said that this man is able to procure that purpose any amount of slaves which is required. There are other slave brokers in Zanzibar, but none of them deals so extensively in human merchandise as Ali Goolah. It seems that a few of two dollars per head have been paid for the servants of a man called Ludha Jaim, who has got the monopoly from the Sultan of Zanzibar. It may be remembered that Dr. Livingstone has expressed a strong opinion that if the slave trade were to be put an end to, the farming of customs duties in Zanzibar must be taken of the hands of the Sultan and put into the hands of Europeans. There is a great deal of plundering going on in connection with business. Moreover, there come grievous complaints from Zanzibar in regard to the manner in which the stipulations agreed to the Sultan in favour of trade and the commercial liberty of foreigners are set aside. The more we learn in regard to the matters at Zanzibar and the neighboring coast, the more our astonishment is red and the more inclined are we to ask what Bombay Government and the Political Agent Zanzibar have been doing for many years as regards the latter there is but one subject to be found in the minds of our English officials who have to do with the explanation which they have for explaining the conduct of weak and wrong-headed English officials who have to do with the States in the East, and in applying why are more often wrong than right. We not attach any undue importance to this kind of, but, really, the suspicion is excited by the violent scurrilous attacks which have been made in the *Times of India* upon Sir Bartle Frere in connection with his appointment, and the attempts to draw a line across the scent by such absurd statements that by treaty with Egypt and the Red Sea is a harbour of refuge for all meaning, by that clumsy phrase, for the slave trade.

And we trust that Sir Bartle Frere will lose no time in inquiring after that modest gentleman. We should also like to know something more about this fee of two dollars per head which is levied upon the removal of slaves. It is not very much to charge for the liberty of taking a negro to Arabia or elsewhere in order to sell him as a slave; but it is obvious that it would be a very exorbitant tax on the mere removal from place to place in the Zanzibar dominions of domestic slaves. We understand that though so many slaves are allowed to go out of Zanzibar, evidently in order to be sold in foreign countries, yet when this fee of two dollars per head is not paid upon them, no difficulty is experienced by the authorities in seizing them and bringing them back to Zanzibar, and in punishing the slave-traders. About four months ago a large number of slaves with their owners were captured and brought back to Zanzibar on account of not having paid this fee. The owners were confined for a few days, and then they were liberated and allowed to dispose of their slaves in Zanzibar only. It is also asserted that some of the buggalows belonging to the dealers in slaves sail under the French flag. The nacodas of these vessels hire negro residents of Zanzibar and take them to the French Consulate to be articulated as seamen on board the respective buggalows. These negroes, according to their instructions, article themselves under assumed names, and the nacodas receive certificates accordingly from the French Consul. But when the buggalows, about to sail, slaves are put on board of it, a number of a certain number of the fraudulently obtained certificates are shown, and the inquiry is stopped. The tricks of slave dealers are endless, and it is most desirable to cut at the root of the accursed traffic.

THE GERMAN OFFICIAL ACCOUNT OF THE FRAZIO-PRUSSIAN WAR.

(From the *Times*.)

THE official account of a great war, written within a few months of the events which it describes, must always be of more than ordinary value, and it is interesting to know whether it is accurate, whether it comes from a victor or a vanquished. But the successful army has advantages not possessed by the defeated. Its Headquarters Staff has more leisure at the time, more opportunities for receiving and digesting reports which are themselves more likely to be accurate. It captures many documents from the enemy, and loses few or none; and, above all, it has less reason for hiding misadventures. Among all the histories of the war none is likely to be so trustworthy as that issued by the Prussian Staff, and all the more because it has the advantage of studying the unexplained facts put forth on the French side in the campaign. Captain Clarke's translation of Von Moltke's history is hailed as a real boon by English students. The volume now issued contains only the account of the war, the mobilization and the plan both sides, and the execution of these up to the end of July, 1871, together with a detailed description of the forces which were to be sent to the military theatre in Europe. Yet it tells enough to prove how hopeless was the French cause, and how uncommenced, to prove how uncommenced the German chiefs were in the short of perfection in their corrections, faults made apparent in previous campaigns. In speaking of the book we shall treat it as written by Von Moltke himself, as it certainly has been, at least under his supervision.

As the thought of great and civilized nations, united with mutual jealousy and hatred, grows as is the shock to the minds of philosophers and moralists, it must be confessed that no—even neither Christianity, nor philanthropy, nor even commerce—has yet been able to bridge the passions of men and prevent them from flying at each other's throats. Individuals may be tamed to submit to an impartial law, but it seems that, as much as ever, nations may fall under kind of madness, which, call it by what name will, is in reality an enthusiasm for slaughter.

What might be the occasion found for the collision, war between France and Germany was inevitable. The wars of the Republic and the Empire shook indeed the strength of France, but left her in possession of the French Republic, on Moltke says, had been "a torn Empire of Germany in the time of its infancy." The riches of her soil and the genius of her people enabled France to recover fully the vigour she had lost. Wealth increased, and an unexampled point in the reign of Napoleon III., who clung to the throne only by satisfying himself with the material prosperity of the country, and by flattery that love of glory so characteristic of the people. When the divisions of Germany ceased the expulsion of Austria from the Confederation, when Prussia placed herself at the head of Northern Germany and the heritor of the name of Frederick the Great assumed the command of all the German territories, France awoke to the contemplation of a mighty Power beside her, and a powerful and proud division and weakness unity in arms where dissension had formerly prevailed, and of the military system of the world, worked by soldiers of high talent, who before had stood a number of petty armies useful to neutralize each other. At the head of this military machine was one man, styled by such an array of talent, military, political, as has hardly been collected. Moreover, it was fully understood that the aggrandizement of Prussia would never till Germany should become one Empire, and the House of Hohenzollern. No longer France retain her undisputed military supremacy, no longer dictate the declarations of war of terms of peace among other nations, no longer were the councils of Europe, unless she had first made good her title to the position claimed at the point of the sword. She had impotent in 1866, and had since been the laughing stock of the Germans by Bismarck. On other hand, the Germans, standing at the threshold of complete unity, were forbidden to enter, and sometimes, in the Leipzig affair, even compelled to withdraw, stretched foot or hand. The French felt to be their enemies as much as to be when the whole land was overthrown; and if the Germans at this time had been, they felt it could only be won through blood and iron. Both countries were consequently preparing for a struggle. The only question was—When would it come, and how bright it? The Emperor Napoleon III. is notably a lover of peace and

plenty; but he had built his throne upon the support of his soldiers, and he felt that it was tottering, when, in spite of all flattery and management, a considerable proportion of those soldiers signified their change of feeling towards him in the *public* taken by his own command. From that moment there was no hope for him but in the chance of a military success. If he engaged in war with a minor power it was certain that the opportunity would be seized by Prussia to complete the unity of Germany. No successes could atone for that, if once it were accomplished. Nothing, therefore, remained but to try this greatest of questions with the sword.

The Prussian Court was believed throughout Germany to be averse from a speedy settlement of the difficulty, for Prussia might be swallowed up in a united Empire, and it is remarkable that during this period of anxious attention the Government of North Germany courted observation of its military strength. If Baron Stieffert wrote truthful accounts of the condition of affairs, military and political, his information was by no means difficult of attainment. Foreign officers were invited to study at great manœuvres the readiness of the army for war, and the power of Germany was rather paraded than concealed. As the moderation of the Government was displayed in the withdrawal from Luxembourg, so would it probably have been again manifested in the Spanish question if it had been possible. Up to a certain point, moderation was shown. Though the King of Prussia replied to French complaints by protesting that the question was a Spanish one, and no affair of his, we cannot suppose that the withdrawal of the Prince of Hohenzollern from nomination to the Spanish Crown was contrary to the will of his august relative, and the English Ambassador at Paris expressed his regret that the withdrawal of the Prince was not taken as a settlement of the difficulty. But a triumph of some kind, political or military, was necessary for the safety of Napoleon's dynasty, and Count Benedetti was charged with a message to the King of Prussia, demanding that he should pledge himself never to give his consent should the question of the succession to the Spanish Throne ever be revived. The telegram from the French Cabinet to Benedetti contained, according to the account before us, these words:—

"It is necessary that the King should assure us that he will not again authorize his candidature." The message was delivered by Benedetti to the King on the 13th of July, and definitely declined. Count Benedetti left for Paris on the 14th, and after calling out the French Reserves dated from 3 o'clock in the afternoon of that day, though it was postponed until early next morning to give time for a council presided over by the Emperor, and lasting six hours. It was said that the order was finally decided upon by reason of reports which arrived during the night of the 13th of Prussian preparations. Von Moltke says that at the time "not a soul dreamt of the war being so imminent." When the French Ministerial proposals were laid before the Assembly, the only dissentients of note based their opposition on the ground that France was not ready. The despatches on which the determination for war had been arrived at were laid before a Commission selected by the Chamber on the demand of M. Thiers, supported by M. Jules Favre. On the report and the Legislative Body unanimously, by a large majority, ratified the proposals of the Government, granting a large money subsidy on the 16th and 19th. It is true that when the preparations were called on for their opinions, 34 were against war, 37 divided in opinion, and only 16 distinctly in favour of war. Yet the country followed the lead of the capital, and there can be no doubt that the nation approved, or at least condoned, the war before it actually broke out. Whatever may be thought of the wisdom of breaking the peace at all, it was surely little short of madness to declare war on the 19th, when the preparations of France had scarcely commenced, and no army was collected. It is now examined briefly the preparations on both sides, not only after the note of war had sounded, but what is of still more importance, the preparations made in peace for the war still to come.

The successes of Prussia in 1866 set alight the nations examining their condition for war, and General Trochu's book called attention to many obvious faults of the French system, so loud and clear a voice that the Emperor entrusted his War Minister, Marshal Niel, with the preparation of a new Military Code. By the new code, the military force of France was divided into Active Army, Reserve, and Mobile National Guard. Conscription was the basis of the recruiting system. The conscript served for five years, with the colours at four years in the Reserve—that is, he served at all; for, substitution being allowed, the men found it worth their while to pay a certain sum of money, in consideration of which, if soldier or other, generally a man useful for some other purpose, would consent to remain in the ranks, and the richer conscript free. To such an extent was this system carried, that, in 1869, out of a total contingent numbering 75,000 men about 42,000 availed themselves of the opportunity afforded them for shirking military service. Only part of each year's contingent was actually sent to the soldiers' work steadily and persistently. The rest of the conscripts only served five months in all, spread over three years, though they were always at the disposal of the War Minister. The Reserve could only be called in by Imperial decree, when there was danger of war, and there were further difficulties, which we shall speak presently. The object of the Reserve was to reinforce the field army, to garrison fortresses, and to form depot troops. The Mobile National Guard was composed of men supposed to be fit for service, who had escaped conscription for one reason or another, and only one day at a time. If we subtract from the day the time taken in going to and from the drill ground, often a distance of several miles, and the time occupied in clothing and equipping themselves for drill, it will appear evident that but a very few hours annually were spent in learning soldiering; moreover the reorganization scheme would not be completely carried out before 1875, and Marshal Niel's successor, Le Bon, considered that such a National Guard was of no practical value, and allowed its organization to remain uncompleted, if not to fall through altogether. About the middle of July, 1870, the strength of the French Army, including the so-called 1869 Contingent, which would not, however, be enrolled till the 1st of August, 1870, numbered about 567,000 men, but in that total were included non-effective various sorts, 50,000; Gendarmes, 24,000; Depots, 28,000; Home garrisons, 78,500; Algeria, 50,000—total, 230,500. Deducting these from the 567,000 there remains an army for the field of about 336,000—rather less than the Prussian General Staff had calculated to meet. But not even this number was really available for the French system of mobilization

in 1870 was almost as bad as ours would be now, if, under our present military organization, we were to attempt to devise a scheme for mobilizing the army; for the vice of the French system was the same as our own, and may be summed up in one word—Centralization.

It is said that when the Emperor asked his War Minister whether the army was ready for a campaign, Le Bon's answer was that they wanted nothing, "not even a button to gaiter." Much indignation arose when it was found that the army assembled on the frontier wanted almost everything that was necessary to render it capable of motion. Yet, strange as it may seem, the words of Le Bon were actually true; the stores were in existence, and were for the most part used in a later period of the war, but they were in their wrong places at the moment of mobilization. The French system, like our own, was based upon a maximum of responsibility upon the Government and in the capital, a minimum of trust reposed in the commanders of country districts. The chassépot was at that time, with all its defects, the best infantry arm in Europe, and there were available 1,037,555 chassépots. So that, deducting 30,000 handed over to the navy, there remained more than three times the number required for the field army. In addition to this the small arm factories could turn out monthly 30,000 stand of arms. The field gun had not been improved since France, first of all nations, employed rifled artillery in war. But the difference in efficiency between it and the Prussian field piece was very slight in comparison with the superiority of the Chassépot over the needle gun. At the beginning of the war the French possessed no less than 3216 rifled field guns, besides 581 rifled mountain guns, and 190 mitrailleuses, giving a total of nearly 4000 pieces of artillery. There were 3178 gun carriages; 7435 ammunition waggon, so that there was sufficient material of modern construction for 500 batteries of six guns each. Besides these there were all the material for 360 smooth-bore batteries. But there were only horses and men available at hand for the 164 batteries of the field army, and of these 10 batteries were in Algeria and Civita Vecchia. So that, inclusive of mitrailleuses, batteries, only 924 pieces could really take the field at the end of July. The Grande Mobile had a very inferior armament; and, as there was no organization for the equipment of a second army for the field, the field army then being mobilized upon the frontiers was the sole hope of France. To that mobilization we will now direct our attention.

As is the case in England, only a part of the Army had any definite organization in corps—namely, the Guard, the Algerian troops, the army of Paris and Lyons, and the troops temporarily organized at the Camp of Chalons. When war broke out, separate regiments had to be combined into brigades and divisions; the staffs had to be newly organized, so that, as in England, "the whole war organization was not called into existence until the critical moment had arrived."

The centralization of military administration caused, as it must cause in any country, an overwhelming pressure upon certain departments when the moment for action came. During peace, the material for equipment was concentrated at a few places: The *Intendance* being, as in England, little employed in time of peace, was unused when war came. Stores of transport carriages were accumulated at Vernon and Chateaux-roux, as on our English system, they would be at Woolwich. Depots of camp equipment had been formed principally at Paris and Versailles. No wonder that Von Moltke says, "Rapid distribution to the general mobilization was a work of extraordinary difficulty." According to Marshal Niel's plan the men necessary to complete the war strength of the battalions should be able to join their regiments on the ninth day after the order for mobilization if they happened to be stationed at the depots whence they received their clothing and arms, and Niel had further calculated that the troops could, by using the telegraph to call in their Reserves, be at their stations in readiness to march on the 12th day. Thus, as the order was issued, on the 19th, the troops should have been ready, complete in numbers and in transport, by the 28th of July. But, by the French system, like the English, only 35 out of 100 infantry regiments were in the same garrison with their depots upon the outbreak of war. For instance, the 87th Regiment was at Lyons, while the depot was at St. Malo. The 98th was garrisoning Dunkirk, but its depot was at Lyons. Thus, every soldier not actually serving with his regiment was quartered, had to be forwarded to his depot, and, when clothed, to be conveyed back to his regiment. Further, the depots themselves had to be supplied with the articles of equipment and with the necessary transport, because these were concentrated in a few places, and, as in England, the system of centralization required that an order should be issued from the War Ministry before arms and many other necessary articles could be supplied. As it was considered essential to get the regiments concentrated into Brigades and Divisions, so as to bring the troops and the Staff together as soon as possible, and, as there was no distinction between the French officer and the private soldier, war was soon followed by a march on the railway trains, and with reserve men flocking to their depots, or from them, to catch their battalions alight in motion. The number of railway trains was insufficient; how could they be otherwise? There was a dense accumulation of men at the different depots, and such a state of confusion, directly consequent upon the system of centralization, that, while some of the Reserves alighted at places where no one new the temporary position of their regiments, the Commandant of the territorial division at Arras telegraphed, "9000 Reserves here; do not know what to do with them in order to give me room. I shall ship them all on board the transports in harbour for Algiers." The Chief of the Staff had to inform the Minister that, according to reports received from the depots, the Reserves were in confusion, but had no instructions where to join a field battalion. Such being the state of confusion, it is hardly surprising that in many cases the Reserves joined their regiments at a deficient of their necessary equipment; many of them were without uniforms, water, food, and tents *d'abri*. The overwork of the staffs appears to have lost all control over the mobilization, and, according to Von Moltke, the Emperor joined the army on the 28th of July, not a single corps was up to its full strength, or in a really effective condition for the field. The regimental and corps transport was incomplete; they were deficient in horses, equipments, commissariat columns, and especially in sick bearers, veterinary surgeons, and medical officers, and official for the administration branch. Most of these last arrived very late. On the 28th the Intendant of the

waggon for want of men and horses. Much of the harness belonging to the Artillery Train was of no use. Some of the ammunition reserves were not at hand. Others were incompletely equipped, and in some places there was no mitrailleuse equipment whatever. Large consignments of maps had arrived—maps of Germany, but not one of the frontiers of France!

Such being the internal condition of the Divisions concentrated for an offensive movement against Germany, a further and even more startling fact remains to be told. There were whole bodies of troops of whose stations the Headquarters Staff were in complete ignorance. The Chief of the Staff had to telegraph to General Douay, "How far have you progressed with your formation? Where are your divisions? The Emperor commands you to hasten their formation with a view to joining MacMahon in Lower Alsace as quickly as possible." Next day the same General, in reply to an application, was told that "There is no train division in Metz and no camp equipment which can be placed at your disposal; you did well to apply to Paris; renew your request." Paris, Paris, Paris; always Paris had to be applied to. If Reserves were assembled and could not move, they could only apply to Paris for help; if a batch of them found themselves dropped at a railway station where no one knew anything of them, they had to telegraph to Paris. If a General wanted horses, carriages, food, clothing, he could not get an animal, or a vehicle, or a ration except from Paris, or by an order sent from Paris. And from Paris at last came orders denuding the fortresses of such supplies as they had, and of almost all their troops, for the strengthening and sustenance of the field army. All this wretched confusion occurred, not because there were no stores, but because the War Office at Paris had kept all the administration of them in its own hands, and had never understood the vastness of the task of mobilizing a great army. Let no smile pass over the face of an Englishman when he reads Von Moltke's account. We, the practical nation, *par excellence*, are in no better case at this moment. We have the same evil system of centralization, the same blind confidence in what we could do on the spur of the moment; and the case of France in 1870 would be ours if we were called upon suddenly to mobilize all our available troops to resist invasion. The difficulty has nothing to do with conscription, or general service. These give many men, but not organization. The French have conscription, and a talent for administration. The real truth lies in this—that an army is never tried except in war. If the officials charged with its organization and administration are not students of war, if the army is regarded as a peace weapon or a political plying, it will never be fully prepared for that supreme moment when only it is of any real use.

But how came it that the French Army and nation had suffered such a state of things to exist? Were there no statesmen to protest, no officers who loved their country better than the favour of Marshal or Emperor, none to break through rules or etiquette and set France free? There were such, but they were few, and their voices were soon stifled by the Court and the Government should become unpopular as soon as their carelessness became known. The army had been so often used to subvert the Constitution that no ruler dared trust it unless he held in his own hands all the guiding strings and could keep the troops devoted to his interests by a system compounded of flattery and despotism. The Germans always speak in high terms of the gallantry of the French soldier, and Von Moltke speaks gently of his faults, as becomes a gallant rival, but he is not silent on the subject, and his words are worth attending to. We will endeavour to give their import as plainly as we can.

The internal state of the French army had many serious defects. The law on re-engagement, exceptions, and endowments had a prejudicial influence upon the French soldier, and the long furloughs formerly unknown, had a tendency to damage his military discipline. So that even in the opinion of his own countrymen he was not in 1870 what he had been in the Crimea and in Italy. The non-commissioned officers appear to have been of a different type, a killing frost had nipped, in a night, the promise of yesterday, and blackness, corruption, and apathy reigned where beauty was so recently conspicuous. Now we do not mean to teach that in like manner shall disaster attend the day of forth by the Agent, but we must record the fact that a degree of disappointment will manifest itself.

At the other business arrangements, so in this, the results will not always be from blenheim, the thorns will be mingled with the roses. Daily experience and past history alike proclaim that, as in the seed time, so will the harvest be. "So well, and you will reap well," is a maxim which is universally true.

The Life Agent who devotes himself unreservedly to his duties, who prescribes his cause early and late, and who is not afraid to stand up for his principles, one will not fail to obtain a proportionate reward. The sowing may be effected in the most judicious manner, but the beginning may be made in a very limited way, but a determined will can surmount all impediments, and amid apparently arid pastures, cultivate a large and prosperous harvest. Thus Samuel Budgett, "the Successor Merchant," reared a princely fortune on the foundation of one single sheep, the proceeds from the sale of a horse's skin which he had found.

Life Assurance was once a small struggling thing; but now it has attained a splendid and powerful. Its success has been a very useful one. We see for it in the future a brilliant and useful career. We bid it God speed on its mission. Regular endeavours on the part of the Agent, at the great the man. The Emperor's policy. The life policy. The principle of the policy, which is the basis of the policy, and the Emperor's policy. No other policy. It will be observed, we are all in the same boat. We shall never hear of it. Accumulating years. In the forms of doubt will be a very serious matter. The Emperor's policy. The life policy. The principle of the policy, which is the basis of the policy, and the Emperor's policy. No other policy. It will be observed, we are all in the same boat. We shall never hear of it. Accumulating years. In the forms of doubt will be a very serious matter. The Emperor's policy. The life policy. 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INVASION PANICS AND THE MEANS OF NATIONAL DEFENCE.

THIS is the time of the year when the possibilities of the invasion of England being accomplished with success are commonly canvassed. It might also be added to the notes in the calendar—"August—th: Parliament separates for grouse-shooting, and invasion panics are due." The fact probably arises from the death of other topics of conversation, and from the space just now at the disposal of our daily contemporaries. When the session has come to an end, it leaves an awful blank behind; and the sub-editor who is left in charge, vice his chief, who has gone to Switzerland or to Scotland, is at his wits' ends to know how to keep the circulation from falling more than twenty-five per cent.

The meeting of the Emperors at Berlin is the only topic of political importance to Europe. Is it peace, or is it war? To this question the German papers answer, peace. In the meantime—as Prussia has, since the French war, done all in her power to strengthen her marine force and fortify her ports—it is not unnatural that we should look to the Government how we stand ourselves in case of a general sea-borne invasion, in spite of the assurance of an inspired German paper that "the Berlin interview is a pacific demonstration, calculated to bring back to its normal state of equilibrium the position of Europe, which was somewhat shaken by the events of 1870-1." Europe could not obtain a stronger guarantee of peace than an agreement between the three great Powers of the Continent, in which Italy, who requires peace above all things, will also join.

It has been said that the military strength of a country consists of three distinct things—Men, and the organization requisite to obtain and train them.

Stores, and the administration requisite to preserve and distribute them.

Administration, or the power to keep the men supplied with food and shelter.

Now, what is the force of the British army available in men? We are told it consists of 63 battalions of 560 men each, or some 34,160 infantry, and about 20,000 cavalry, artillery, and engineers. It is admitted that 20,000 men have been reduced; but to compensate for this a first reserve of 1900 men, and a second reserve of 21,870, have been formed, and credit is taken for the difference between the 23,770 and the 20,000! Behind these, in second line, are the old troops, and the militia and yeomanry, about 96,700; and the volunteers, 170,581 men.

A writer on this subject, in 1870, asked—"Who is there who dares to say that the military institutions of this country might not be put on such a footing as to afford an army which would produce respect from our neighbours, security at home? Such institutions would bring class in contact with class, go far to humanize the rough, reform the dissipated, and knit together the various elements that constitute society with bands of iron."

We naturally look for information on the subject of our condition, were we called upon to defend ourselves—distant as such a contingency probably is—to other than lay writers. Among military men, Colonel Drummond Jervis is perhaps as good an authority as we can consult, and his remarks at the Royal Institution on the subject are summarised in this paper:

During the year 1869, the total tonnage of British and foreign vessels entered and cleared at ports of the United Kingdom was no less than 34,910,281. Of this total value, £532,475,266. Of this enormous trade, a large proportion is of the last importance, not only to the prosperity, but to the very life of the country. Grain and flour to the value of thirty-seven millions sterling were imported in 1869. Whatever may happen, it is absolutely necessary that this trade should not be altogether stopped. Some millions' worth of foreign corn we must have, or we shall starve. There is a trade of about 98 millions with the northern and the western countries of Europe; of 723 millions with the countries bordering the Mediterranean; of 83 millions with India and the East, of which a portion also passes through the Mediterranean; of 11 millions with Africa and the Mauritius; and of 25 millions with Australia. Turning to the westward, we have a trade of 513 millions with the West Indies, Central and South America, and of no less than 80 millions with the United States and our colonies in North America.

We must have swift and powerfully-armed vessels adapted to cope with the cruisers which would be launched against our trading ships, and armour-plated men-of-war to meet external attacks which might be made against foreign territories under British rule.

In connection with the necessity for the maintenance of naval squadrons abroad, it is of paramount importance to defend effectively the foreign stations at which our cruisers must be coiled and repaired.

Malta and Gibraltar for the Mediterranean, Halifax and Bermuda for the Atlantic, Port Royal, Jamaica, from its position with reference to the West Indies and the Gulf of Mexico, Bombay and Aden,—Simons Bay, at the Cape of Good Hope,—Port Louis, Mauritius, a harbour in Ceylon, Singapore, Hongkong, and some other ports, are, in military language, the strategic bases for our foreign squadrons.

The defences of several of our important colonial stations are being provided for by the respective colonies themselves. But they cannot yet take part in their external protection, and this we acknowledge that it is our duty to afford.

One most important function the navy has to perform is to keep open the ports of the United Kingdom for the ingress and egress of our merchant ships. Unless the shipping of the Thames, the Mersey, the Clyde, and numerous other ports be free to come and go, it will be of little avail to protect our foreign possessions. The measures adopted should be of course suited to the circumstances of each locality. As regards fixed defences on shore, an idea is prevalent that earthwork fortifications could easily be extemporized for the protection of our commercial ports; but to any one who is aware of the nature of the appliances of a modern battery, intended for defence against attack by the powerful guns and ships of the present day, such proposals are known to be utterly delusive. Sometimes the defence of a port can be wholly provided for by shore batteries, supplemented by torpedoes; sometimes it is best to provide for it partly by shore batteries and partly by turret-vessels and gunboats, aided by torpedoes; and in other cases it may be desirable to employ floating batteries only in the defence.

As regards garrisons for the works defending our commercial harbours, besides the militia, we have large bodies of volunteers. These, if trained to the service of heavy rifled guns, by a few experienced Royal Artillerymen, who should be stationed at each place, and who should have charge of the works and armaments, would be thoroughly efficient for the

service of the guns in the batteries. Without such batteries these artillerymen are like infantry without rifles and are useless. On the other hand, if the batteries were provided, they would form a very important element in our arrangements for defence.

Whilst these would man the land batteries, the gunboats might be manned by local seamen, under naval officers. A few military engineers would be required for the working of torpedoes, the stores for which do not deteriorate by keeping, and should always be ready on the spot. The defence of the commercial ports would thus be complete.

Our maritime frontier must be placed—it is to a great extent already placed—in a condition for defence. We have what I may call naval entrenchments on the southern coast of the kingdom, at Portsmouth and Plymouth, at Portland, at Pembroke, at Chatham, Dover, and Cork. A large fortified harbour on the eastern coast is still wanted. In the late discussions in Parliament, the proposal for a harbour at Filly Bay was discussed as if it were solely required as a refuge for the mercantile marine; but such a harbour, if fortified, would be the Portland of the eastern coast. From these naval entrenchments our squadrons for the coast defence would issue for the protection of the adjacent shores; upon them our fleet might retire in security if assailed by superior force. The fortifications of such places protect the coaling, the dockyards, the factories, the stores, the magazines, the anchorages for our navy, and when properly garrisoned they render them perfectly secure against attack.

Some other harbours, such as Harwich and Newhaven, would also form valuable points d'appui for gunboats and light-draught vessels, acting for the defence of the coast; and for this as well as for another reason—viz., that they would be good bases of operation for an enemy they are being fortified; indeed, a strong fort, which will completely protect the harbour at Newhaven, is just completed.

The Humber, which in addition to its value as a commercial port, is a harbour of strategic importance, should also be strongly defended; and the several anchorages within certain limits, in which an enemy's fleet might lie, with a view to ulterior operations, should, where practicable, be made to him, by some powerful guns placed in small secure forts.

There are several minor harbours, viz.:—Pole, Chichester, Littlehampton, Shoreham, Folkestone, Rye, Ramsgate, the Blackwater, &c., which, though only tidal, would form very convenient places for an enemy to land his artillery, horses, and stores. These ought to be defended by a small strong work at each, to prevent their seizure by an enemy, and thus the operations of an invading force would be restricted to the open beach, and rendered liable to interruption from bad weather.

As regards the regular army, it is generally considered that we should maintain a comparatively small force, complete in all its branches; and that after having received a thorough training in this army, men should be passed to a reserve, by means of which, on occasions requiring, the available regular force may be largely increased. Some propose that the militia shall be reorganized, and more or less connected with the regular army. With regard to the volunteers, every possible encouragement and assistance should be afforded to bring these forces up to such a standard of efficiency as will enable them to fulfil properly the rôle assigned to them in national defence.

Let us consider the plan of operations which an invader would be likely to adopt. There can be no doubt but that his great object would be to march upon London, and with this view his main descent would be upon our eastern or southern shores. If Portsmouth and Plymouth were not fortified to landward, he might detach a corps to burn the ships and naval establishments at one of these places. The fortifications of these places, however, garrisoned by auxiliary forces, with a nucleus of well-trained troops, would render these great arsenals secure. The enemy might make a feint, perhaps an attack, by a corps directed upon Ireland. In any case, we must have a large body of troops there. Perhaps, instead of a descent upon Ireland, he might send a corps to the Yorkshire or Lincolnshire coast, in addition to the main attack upon the eastern or southern coast. He would thus at least distract the attention of our defensive forces, and possibly this subsidiary attack might turn out to be one of great importance.

You will observe that if he succeeded in making good a landing with a corps at or somewhere near the Humber, he would be in a position to march upon the great seats of manufacture and a successful advance against Manchester, Liverpool, Sheffield, and other places in the same quarter would probably result in enormous requisitions being levied upon these sources of wealth and manufacturing industry.

In view of an operation of this description, the defence of the Humber, to which I have before adverted, and the establishment of a Central Arsenal, which should probably be somewhere near Sheffield (in preference to Cannock Chase, where it has hitherto been proposed to place it), are both matters of very great importance.

At the same time that an attack or a feint was made on the north-eastern counties, the landing of the main invading force might be effected on the eastern or on the southern coast, with a view of marching upon London.

Until it be clearly seen whether the attempt to the northward was a feint or a real attack, we must keep a force there to meet it. When the line of the attack from the southward was fully developed, we should concentrate upon it, and dispute the possession of the soil, as far as practicable; of course bringing down the force from the north, if not required there. The whole of the active army, except the force in Ireland, and such portions as must be detached for the nucleus of each of the garrisons of our naval arsenals and other fortresses, should be brought together to oppose the advance on London.

All railway arrangements for the ready transport of troops would be made by the military staff, in concert with the managers of the several lines. The telegraph lines are now in the hands of the Government, and would therefore be worked by the same employees as at present.

Temporary works on the probable or expected fields of battle, would be thrown up between London and the coast; these would be executed by bodies of workmen, organized under the Civil Engineer Staff Corps, and under the direction of military engineers, by whom the plans would have been previously prepared. The number of men and tools, as well as the time required for forming each work, would have been previously calculated.

Roads would be broken up, obstacles across them created, railways destroyed, and we should probably fight a pitched battle either on the ranges of chalk hills in Kent or Surrey, near

Chelmsford, or in some chosen positions elsewhere.

Fight, no doubt, we should with fury, but we might be beaten! If so, the enemy marches straight into London. Our army might retire upon the fortified entrenchment at Portsmouth, on the one hand, or upon the fortified Central Arsenal, if we had one, on the other; but with London in the hands of the enemy, what then?

Some say even if London were occupied by a hostile army, we should still continue the struggle. Look, they say, at the case of Madrid in the Peninsular war. Look at Moscow in 1812. Look at Vienna in the wars of the beginning of this century.

But it is almost beside the question to compare these cases, or that of Berlin and other capitals, except Paris, with that of London. The fall of London would render further resistance impossible. With London in the hands of an enemy, then the seat of Government, the heart of the empire, the centre of all commerce, the focus of our communications, our Government factories upon the Greenwich for guns, gun-carriages, munitions, stores (the only Government manufacturing arsenal we possess), the great Naval Arsenal at Chatham, too (which is unfortified to landward), all fall into his hands! There would be a collapse of commerce, of government, and of order, from which there might be no recovery.

What shall the measures of precaution be? The Duke of Wellington, in his memorable letter of January, 1847, said, "I know of no mode of resistance, much less of protection, from this danger, except by an army in the field, capable of meeting and contending with the formidable enemy, aided by all the means of fortification which, experience in war and science can suggest."

As regards the army, I believe that if the regular and other forces which it is proposed to maintain be trained, so as to be efficient for the duties they may be liable to perform, and if, to use the Duke of Wellington's words, they be "aided by all the means of fortifications which experience in war and science can suggest," the defence of the country against invasion will be fully provided for.

Without the aid of fortifications, I submit that it will not be possible, unless compulsory service be resorted to, to organise and maintain an army capable of affording that complete security, to obtain which our military expenditure is incurred.

In this country, on account of its expense, and the withdrawal of men from industrial pursuits, which it involves, there is great repugnance to a large standing army.

The cost of fortification is very small when compared with that of the maintenance of regular troops. The capital cost of an addition of only 5000 men to our regular army may be stated as follows:—

5000 men, with barracks and non-effective charges, at £50 per man per annum	£250,000
Productive labour of 5000 men lost by their being converted into soldiers, say £20 per annum	100,000
Capitalized at 25 per cent.	1,250,000
Total cost of 5000 regular troops.	£1,500,000

Now, an augmentation of 5000 men to our regular army is scarcely worth mentioning as a contribution to the increase of our defensive power; whereas the cost of this addition, if applied to fortification, would, with the forces already proposed to be maintained, for ever settle the question of the invasion of England.

The expense of the necessary permanent fortifications around the metropolis would be about eighteen millions sterling. Add to this the cost of the Central Arsenal, and of the works required for the protection of the sea-ports at home and abroad, referred to, and the whole expense, including armaments, would not be so great as the capital cost of 5000 regular troops. The expense of the maintenance of fortifications is but trifling, and we already have more than an abundance of forces capable of manning them.

The works for the defence of London should be permanent, and provided with plenty of bomb-proof cover and deep well-flanked ditches. They should be impregnable against assault, and the ramparts should be constructed so as to render the artillery therein secure against being silenced by the enemy's fire.

As regards the question where the works should be, there are two principles which have to be considered. One may be called the indirect, the other the direct system.

The indirect plan is, to construct at a distance of 20 or 30 miles from London, three or four fortified entrenchments; one at Chatham (where, in any case, the works proposed by the Defence Commission for the defence of the Naval Arsenal should be carried out), one west, another north, and another south of London. The direct plan is, to construct a series of detached forts, crossing fire with each other, and from about 2000 to 3000 yards apart, according to the circumstances of locality, all round London, at a distance of about twelve miles from its centre.

The principle on which the indirect system is advocated is, that the entrenchments or strategic fortresses, would be capable of containing a large force which might act on the flank or rear of an enemy, and threaten his communications if he passed it; and that an invader would therefore be obliged to sidestep and besiege it, or to employ a large force to make it, before he could proceed on his march to London.

A system of purely strategic fortresses, such as we are discussing, would be imperative unless the forces acting from them were fully equipped, thoroughly trained and disciplined troops. Even admitting that we had sufficient forces of this description capable of taking the field, the safety of London would still be dependent on the result of general action.

Now, the direct system of defense would absolutely cover London; and the whole adult male population, as also the enormous resources of all kinds within the line of the proposed forts, could be drawn upon for the defence of any part of the circle. A ring of fortifications would be at every point after a strong fortified battle-field twelve miles from the centre of London.

The perimeter of the line of fortifications being more than seventy-five miles in extent, it is impossible that it could be invested. The circle of the forts round Paris is less than thirty miles, and it took a quarter of a million of troops to invest it. To invest London, if defended as proposed, would require an army of 700,000 men. The distance of the works from London would be greater than necessary to protect even the suburbs from bombardment.

Paris held out for five months, and then only gave in from want of food—the bombardment did not hasten the surrender. Some how. If Bazaine's army had retired upon Paris instead of being at Metz, after the title of Woerth—if MacMahon had gone to Paris, or to Orleans, instead of to Sedan—or, if Mx had held out

for a fortnight longer than it did—the result of the late war would have been very different to what it was; Paris would have been relieved, and the Germans would have been in a most critical position. The works round London, if we were, and the army doubled in the field, would enable us to retrieve the fortunes of England.—Once a Week.

THE MONTH: SCIENCE AND ARTS.

PROFESSOR Zollner, in his book "On the Nature of Comets," accounts for some of the phenomena by showing that water, mercury, and many other substances, even in the solid state, always give off vapour; hence, a mass of matter in space will ultimately surround itself with its own vapour, and present the appearance of a comet. It is quite probable that some of the masses moving in space may be fluid, in which case, on approaching the sun, the development of vapour would be very rapid, as is well exemplified by some of the smaller comets. And as regards the swift growth of the tail, Professor Zollner demonstrates that if the free electricity of the sun be not greater in amount than that observed at the surface of the earth, it would be sufficient to communicate an impulse which, as exemplified by the comet of 1680, would produce a train or tail sixty million miles long in two days. Having proved this mathematically, he does not think it necessary to seek further for a theory of repulsive force by which to account for the tails of comets.

The professor is engaged also in the discussion of an important question—the Origin of the Earth's Magnetism, and the Magnetic Relations of the Heavenly Bodies. It has been observed that magnetic disturbances occur at places far distant from each other and from the disturbing centre. For example, in 1861, a severe earthquake was felt in Greece; at the same moment, Dr. Lamont, in his observatory at Munich, noticed an unusual restlessness, which continued half an hour. Some years ago, an English observer was watching a sun-spot; suddenly he saw a bright light burst from its centre, and glow for five minutes. He discovered a few days later that in the observatory at Kew, the magnets had all at once started from their position, and were greatly disturbed for a time corresponding to that of the manifestation of the white light on the sun. These are noteworthy evidences of forces acting at a distance, and they bear out Professor Zollner's theory, that "the sun is to be regarded as a magnetic body like the earth." The earth in its annual course round the sun cuts a plane perpendicular to the ecliptic twice a year; and September 6, the south pole of the sun is turned towards the earth, and on March 7, the north pole. Hence, whatever magnetic effects are produced on the earth by the sun, will have their maximum at these two dates.

Physical astronomers are generally agreed that the moon has no atmosphere; but Professor Challinor of Cambridge once fancied that he saw evidence of an atmosphere at the bottom of a lunar valley; and now another observer suggests that the appearances seen at a few moon are also evidences of atmosphere. We see the bright crescent, and dimly the disk of the moon made visible by earthshine; and at the same time the edge which is farthest from the bright crescent shows itself slightly illuminated. This faint illumination it is which is regarded as affording proof that the moon has an atmosphere.

The same observer offers an explanation of the reason why the moon appears larger when low than when high. On a fine night, he says, the vault of heaven never appears like half a globe, but is very much flattened overhead; and the effect of the atmosphere is to make the stars in the zenith seem nearer to us than the stars in the horizon. This may be easily verified by a diagram. Draw a half-circle, and within that a flattened vault. Then draw disks on the outer line to represent the moon, and lines from these to an observer's eyes in the centre, and at once it will be seen why the lowest moon appears to be the largest.

An ingenious method of stopping leaks in iron ships when at sea, has been patented by Mr. McCool, who effects his object by means of what he terms "safety-plates." These plates are, as artisans say, "dished"—that is, they resemble a dish in shape; consequently, when the hollow side is pressed against the plates of a ship, the "safety-plate" fits close, and will keep water out when held firmly in place with screws.

By a clever contrivance, when once the leak is discovered, means can at once be taken for fitting on the new plate; this is laid hold of by lines drawn under the ship; the weight is taken off and replaced by a screw bolt; a plate, with india-rubber covering the inner edges, is next screwed to the bolt, is dropped overboard, and drawn into position by the line hanging through the leak; an inner plate is then screwed to the inner end of the bolt; and thus the leak is completely covered on the inside and the outside, and the water is kept out. That this means of safety can be made use of in the open sea, and under different circumstances, without the necessity of docking the ship, is not the least among its recommendations.

Signor Zuccato, an Italian, has devised an electro-chemical method of copying writings, diagrams, or designs, which, while affording another instance of practical application of science, is hardly fit of general recognition. A description of the method is printed in the Journal of the Photographic Society. A steel plate is covered with a coat of varnish, and this, when dry, the writing or design is scratched or written with a steel point. Should a fac-simile be required, this can be produced on the varnished plate by the process known to photographers, and then scratched, as in the former instance.

The copying is effected in an ordinary copying-press, to which, above and below, wires from an electric battery are connected. Moist sheets of copying-paper, impregnated with salts of potash, are laid on the steel plate, and placed in the press. Immediately that the press is screwed close, the electric current begins to pass, and prints on all the sheets of paper, in from thirty to sixty seconds, whatever is scratched on the plate.

The operation may be repeated as often as is desired; whereby copies can be multiplied to any extent, which in many cases would be highly advantageous. We hear that this new electro-chemical copying press is soon to be offered for sale by an enterprising firm in London.

Paperhangings for walls are known to everybody. It is now proposed to use hangings made of metal; and an account of this new invention, which comes to us from Paris, has been read before the Society of Arts. The metal employed is tin foil, in sheets about sixteen feet long, and from thirty to forty inches wide. The sheets are painted, and dried at a high temperature, and are then decorated with many different patterns, such as foliage, flowers, geometrical figures, imitations of wood, or

landscapes. When decorated the sheets are varnished and again dried, and are then ready for sale. Tin foil is in itself naturally tough, and the coats laid upon it, in preparing it for the market, increase the toughness. The hanging of these metallic sheets is similar to paperhanging, except that the wall is varnished with a weak kind of varnish, and the sheet applied thereto. Thus in this way a room or a house may be newly painted without any smell of paint to annoy or harm the inmates. Moreover, the tin foil keeps out damp; and the protection of the room is twofold. Experience has shown also that curtains, mouldings, and irregular surfaces may be covered with the tin foil as readily as a flat surface; hence, there is no part of a dwelling-house or public building which may not be decorated with these new sheets; and, as regards style and finish, all who saw the specimens exhibited at the reading of the paper, were made aware that the highest artistic effects could be achieved at pleasure.

The decoration of small tin plates for ornamental purposes has, we hear, been introduced into Cornwall—the county of tin. In this case, the colour and pattern are printed on the plates by means of lithographic stones and rollers; but to insure excellence and permanence, the plates must be heated. Difficultly was at first experienced in keeping the plates at the required temperature, the upper part of the oven being always hotter than the lower; but it was overcome by fitting into the oven a vertical roundabout, which carried the plates from top to bottom of the oven, during the whole process of heating. We think there are many purposes to which these plates could be applied beyond that of mere ornaments.

An account of an experiment interesting to arboriculturists has been published in Luxembourg. As some travellers will remember, the roads near that city are planted with trees—ash, maple, and elm, alternately with poplars. The space between the trees was six metres (about seven and a half yards), and it was thought that the poplars, growing fast and tall, injured the other trees, and some hundreds were cut down. The elms, ash, and maples had then twelve metres in which to grow, and they profited thereby, for their annual growth increased from nine to eleven per cent. As the observations necessary to establish this result were carried on from 1859 to 1871, they may be accepted as trustworthy, and are, indeed, such as might have been expected.

Professor Lapham, of the United States Telegraph Service, has drawn up a report on the great forest-fires of last year, some of which penetrated even into the States of New York and Pennsylvania, and he shows that the great prairies of the Far West have been produced and are extended by these fires, aided by the operations of art. In those regions, the autumn months are exceedingly dry, with prevalence of south-west winds. "These conditions of climate," says the professor, "have existed for ages, and hence the normal condition of the great Western plains is that of prairie; and so long as these causes exist, the region must always remain in this condition, unless changed by ingenious and persistently applied devices of art." At present a constant struggle goes on where prairie and forest meet; and generally it is the forest which gives way, and border towns and villages, and the prairie grows bigger. A system of give and take may be said to prevail. In a wet autumn the forest holds its own, perhaps encroaches a little on the prairie; but in a dry season the fires assert their supremacy, and as they kill the roots of everything except prairie grass, the extension of prairie-land naturally follows.

But, as Professor Lapham says, the prairie soil is as well suited for the growth of trees as the forest-land is; and if some untold and enforced endeavour were made, millions of acres might be covered with grateful shade, the extreme dryness of the atmosphere would be mitigated, and the well-founded apprehensions that now prevail as regards a scarcity of timber would be effectually removed.

The Quarterly Journal of the Geological Society contains interesting papers on the diamond fields of South Africa, which should be read by the enterprising folk who desire to have trustworthy scientific information about that now attractive country. One of the explorers states that the diamond gravel is not of local origin, that it has been brought from long distances, and by some other agency than that of water. He considers that the greater part came from the Drakensberg mountain range and its northern offshoots, and he thus sums up his views:—"The vast unstratified deposits, the promiscuous piling together and intermingling of boulders, the remarkable polish of many of them, the terrace-like mounds and accumulations, all evince physical conditions far different from those at present in operation; while the entire absence of all recent fossils in these gravelly alluvial forces on the conviction, that they must have been laid down under circumstances inimical to animal and vegetable life; and these circumstances, judging from similar deposits in other countries, have been brought about by the action of ice."

Another scrap of geological news appears to confirm Mr. Darwin's supposition that Brazil, and indeed the whole continent of South America, is slowly rising. The group of islets known as Fernando Noronha is one hundred and ninety-four miles from Cape St. Roque, the most easterly point of the southern continent. The channel between the islets and the main is shallow when compared with the deep water of elevation on the islets, the inference is, that, with the gradual upheaval, they will some day be connected with the cape by a long neck of heart-disease. In 1851, the number of deaths was 5746; in 1870, it was 12,428, or more than double. Truly, the Scriptural precept, "Make not haste to be rich," has more than a moral significance; and, as a medical contemporary remarks, the foregoing figures "warn us to take a little more care not to kill ourselves for the sake of living."

People who look at the death-lists in newspapers can hardly have failed to notice of late years an increasing frequency of announcements of sudden death. Some explanation of this fact has been published by the Registrar-general and the medical journals, which shows that heart-disease has as much to do with the increased mortality under the head above referred to. But it may be asked: "Whence comes the heart-disease?"

The answer is: From the stress and strain under which people now try to get a living, every one striving to be first, and to win more fame or more money than his competitors. It seems as if human beings in their daily transactions were trying to rival the express train and the telegraph; and as the rule is, among men between twenty and forty years of age, and not among women, that the death from heart-disease occurs. In 1851, the number of deaths was 5746; in 1870, it was 12,428, or more than double. Truly, the Scriptural precept, "Make not haste to be rich," has more than a moral significance; and, as a medical contemporary remarks, the foregoing figures "warn us to take a little more care not to kill ourselves for the sake of living."

A NEW THEORY OF VOLCANOS.

(From the Spectator.)

THERE are few subjects less satisfactorily treated in scientific treatises than that which Humboldt calls the Reaction of the Earth's Interior. We find, not merely in the configuration of the earth's crust, but in actual and very remarkable phenomena, evidence of vast forces of great activity, and the problem suggested seems in no sense impracticable, yet no theory of the earth's volcanic energy has yet gained general acceptance. While the astronomer tells us of the constitution of the sun, millions of times farther away than our own sun, the geologist has hitherto been unable to give an account of the forces which agitate the crust of the orb on which we live.

A theory has just been put forward respecting volcanic energy, however, by the eminent volcanologist Mallet, which promises not only to take the place of all others, but to gain a degree of acceptance which has not been accorded to any theory previously suggested. It is, in principle, exceedingly simple, though many of the details (into which we do not propose to enter) involve questions of considerable difficulty.

Let us, in the first place, consider briefly the various explanations which have been already advanced. There was first the chemical theory of volcanic energy, the favourite theory of Sir Humphrey Davy. It is possible to produce on a small scale nearly all the phenomena due to subterranean activity, by simply bringing together certain substances, and leaving them to undergo the chemical changes due to their association. As a familiar instance of explosive action thus occasioned, we need only mention the results experienced when any one unfamiliar with the methods of treating lime endeavours to over-haul a "slake" or "slack" it with water. Indeed, one of the strong points of the chemical theory consisted in the circumstance that volcanoes only occur where water can reach the subterranean regions—or as Mallet expresses it, that "without water there is no volcano." But the theory is disposed of by the fact, now generally admitted, that the chemical energies of our earth's materials were almost wholly exhausted before the surface was consolidated.

Another inviting theory is that according to which the earth is regarded as a mere shell of solid matter surrounding a molten nucleus. There is every reason to believe that the whole interior of the earth is in a state of intense heat; and if the increase of heat with depth (as shown in our mines) is supposed to continue uniformly, we find that at very moderate depths a degree of heat must prevail sufficient to liquefy any known solids under ordinary conditions. But the conditions under which matter exists a few miles below the surface of the earth are not ordinary; the pressure enormously exceeds any which our physicists can obtain experimentally. The ordinary distinction between solids and liquids cannot exist at that enormous pressure; a mass of cold steel could be as plastic as any of the glutinous liquids, while the structure of change which a solid undergoes in the process of liquefying could take place under such pressure even at an enormously high temperature. It is now generally admitted that if the earth really has a molten nucleus, the solid crust, must, nevertheless, be far too thick to be in any way disturbed by changes affecting the liquid matter beneath.

Yet another theory has found advocates. The mathematician Hopkins, whose analysis of the molten-nucleus theory was mainly effective in rendering that theory untenable, suggested that there may be isolated subterranean lakes of fiery matter, and that these may be the true seat of volcanic energy. But, as lakes could not maintain their heat for ages, if surrounded (as the theory requires) by cooler solid matter, especially as the theory also requires that water should have access to them. It will be observed also that none of the theories just described affords any direct account of those various features of the earth's surface—mountain ranges, table-lands, volcanic regions, and so on—which are undoubtedly due to the action of subterranean forces. The theory advanced by Mr. Mallet is open to none of these objections. It seems, indeed, competent to explain all the facts which have hitherto appeared most perplexing.

It is recognised by physicists that our earth is gradually parting with its heat. As it cools it contracts. Now if this process of contraction took place uniformly no subterranean action would result. But if the interior contracts more quickly than the crust, the latter must in some way or other force its way down to the retreating nucleus. Mr. Mallet shows that the hotter internal portion must contract faster than the relatively cool crust; and then he shows that the shrinkage of the crust is complete to occasions all the known phenomena of volcanic activity. In the distant ages when the earth was still fashioning, the shrinkage produced the irregularities of level which we recognise in the elevation of the land and the depression of the ocean-bed. Then came the period when, as the crust shrank, it formed corrugations, in other words, the foldings and elevations of the somewhat thickened crust gave rise to the mountain-ranges of the earth. Lastly, as the globe gradually lost its extremely high temperature, the continuance of the same process of shrinkage led no longer to the formation of ridges and table-lands, but to local crushing down and dislocation. This process is still going on, and Mr. Mallet not only recognises here the origin of earthquakes, and of the changes of level now in progress, but the true cause of volcanic heat. The modern theory of heat as a form of motion here comes into play. As the solid crust comes into the shrinking nucleus, the work expended in crushing down and dislocating the parts of the crust is transformed into heat, by which, at the places where the process goes on with greatest energy, "the material of the rock so crushed and of that adjacent to it are heated even to fusion. The access of water to such points determines volcanic eruption."

Now, all this is not mere theorising. Mr. Mallet does not come before the scientific world with an ingenious speculation, which may or may not be confirmed by observation and experiment. He has measured and weighed the forces of which he speaks; he is able to tell precisely what proportion of the actual energy which must be developed as the earth contracts is necessary for the production of observed volcanic phenomena. It is probable that nine-tenths of those who have read these lines would be disposed to think that the contraction of the earth must be far too slow to produce effects so stupendous as those which we recognise in the volcano and the earthquake. But Mr. Mallet is able to show, by calculations which cannot be disputed, that less than one-fourth of the heat at present annually lost by the earth is sufficient to account for the total annual volcanic action, according to the best data at present in our possession.

This would clearly not be the place to follow out Mr. Mallet's admirable theory into all its details.

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"Man would have a mark extruded upon the face of the earth, as a mark of his power."—Mallet.

"The earth is a great machine, and the human mind is a part of it."—Mallet.

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The Sydney Morning Herald
(NSW : 1842 - 1954)

Issue 1873-01-02

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